SMPTE 12M-2-2008
Revision of RP 188-1999

SMPTE STANDARD

for Television — Transmission of Time Code in the Ancillary Data Space

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Approved February 7, 2008
Correction to Table 7 Heading made on August 26, 2009

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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Administrative Practices.

SMPTE Standard 12M-2 was prepared by Technology Committee S22.

Introduction

This section is entirely informative and does not form an integral part of this document.

This standard forms a portion of one of the oldest SMPTE Standards for Television. SMPTE Time Code was developed originally for analog television recording systems and thus dealt only with interlaced television systems operating with frame rates up to 30 frames per second. It is, however, flexible enough in design to be used in digital television systems, both standard definition and high definition. The actual transport of the codewords for digital systems varies significantly from the transport methods defined for analog systems, and is defined in this document (formerly named SMPTE RP 188). The time and control code information is carried as the payload of ancillary packets which are located in the Ancillary data space of a digital television signal. This type of a time and control code transport is applicable to 8-, 10-, or 12-bit television systems.

For television storage systems the time address that forms part of the time code is primarily intended as a label to identify discrete frames.

1 Scope

This standard defines a transmission format for conveyance of linear (LTC) or vertical interval (VITC) time code data formatted according to SMPTE 12M-1 in 8-, 10-, or 12-bit digital television data interfaces. Time code information is transmitted in the ancillary data space as defined in SMPTE 291M. Multiple time codes can be transmitted within a single digital video data stream. Other information (such as real time clock, film transfer, DTTR tape timer, and user-defined information) may also be carried in the ancillary time code packet.

This standard is applicable to digital television data interfaces, whether high definition or standard definition.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

3 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE 12M-1-2008, Television — Time and Control Code

SMPTE 291M-2006, Television — Ancillary Data Packet and Space Formatting

SMPTE RP 168-2002, Definition of Vertical Interval Switching Point for Synchronous Video Switching

4 Definitions and Acronyms

4.1 Ancillary Time Code (ATC)

The acronym ATC refers to the bitstream carried in either the Vertical Ancillary space (VANC) or the Horizontal Ancillary space (HANC) of a digital television data stream, as described in this document, and is used to convey time code data formatted as LTC, VITC, or both.

Note: ATC may also be used to carry other information as defined in other documents. ATC is a data transport applicable to both High Definition television (HDTV) and Standard Definition television (SDTV) digital video formats.

4.2 Frame

A frame contains all of the lines of spatial information of a video signal required to make up one complete picture (including any necessary associated synchronization lines). For progressive video, these lines contain picture samples, captured at one time instant, starting from the top of the frame and continuing through successive lines to the bottom of the frame.

4.3 Field

For interlaced video, a frame consists of two fields. One of these fields will commence one field period later than the other. See SMPTE 170M for an example of such a system. Composite television standards require multiple fields in a “color sequence,” but that does not alter this document’s nominal terminology.

4.4 LSB

Least significant bit.

4.5 MSB

Most significant bit.

4.6 UDW

The acronym UDW is an abbreviation for “user data word" as defined in SMPTE 291M.

5 Format of Ancillary Time Code Packets

Each data packet shall comply with the format defined in SMPTE 291M for a type 2 ANC packet. It consists of the ancillary data flag (ADF), the data ID (DID), the secondary data ID (SDID), the data count (DC), the user data words (UDW), and the checksum (CS). The UDW consists of the data payload.

The DID and SDID shall be set to:

DID 60h

SDID 60h

The data count word for ancillary time code shall be set to:

DC 10h

References to User Data Word (UDW) bits in this standard are for a 10-bit User Data Word. Correspondence between an 8-bit word and a 10-bit word is shown in Table 1. In the case of 12-bit representation, the ancillary data is defined by the seven most significant bits of the 12-bit data and the five least significant bits are defined to be zero.

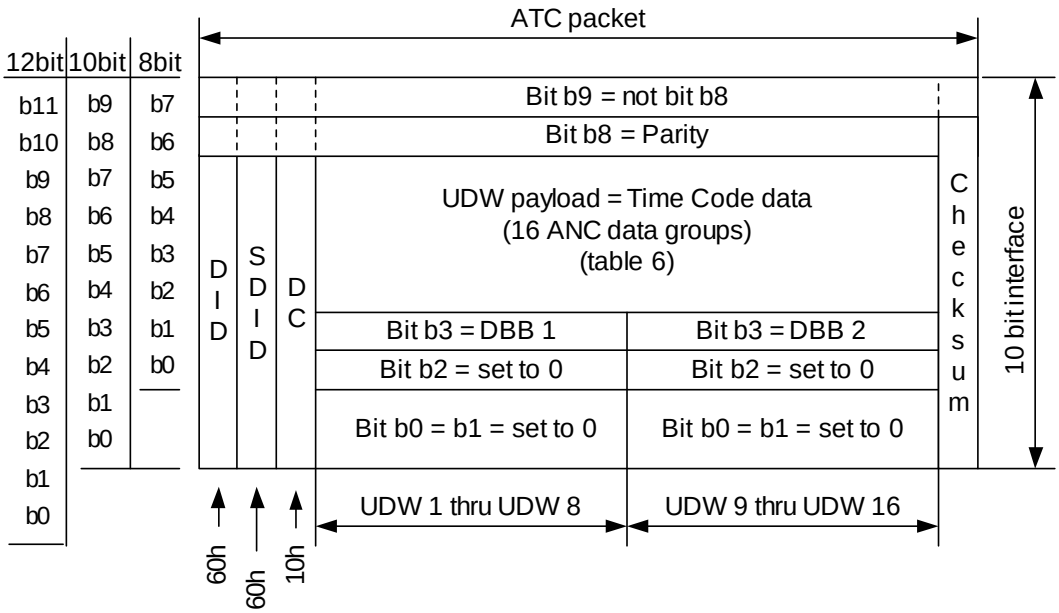


Figure 1 – Ancillary Time Code packet format

5.1 Ancillary Time Code Packet Layout

One ancillary data packet shall fully represent an ancillary time code (ATC) codeword (see Figure 1).

5.2 User Data Words in Ancillary Time Code

All User Data Words of the Ancillary Time Code packets are formatted as shown in Table 1.

Table 1 – User Data Word (UDW) format

UDW bit (12-bit words)	UDW bit (10-bit words)	UDW8 bit (8-bit words)	Assignment
b0 (LSB)	N/A	N/A	Set to 0 in 12-bit words, N/A in 10-bit and 8-bit words
b1	N/A	N/A	Set to 0 in 12-bit words, N/A in 10-bit and 8-bit words
b2	b0 (LSB)	N/A	Set to 0 in 12-bit and 10-bit words, N/A in 8-bit words
b3	b1	N/A	Set to 0 in 12-bit and 10-bit words, N/A in 8-bit words
b4	b2	b0	Set to 0 in 12-bit, 10-bit, and 8-bit words
b5	b3	b1	Distributed binary bit (DBB)
b6	b4	b2	ANC binary group LSB
b7	b5	b3	ANC binary group
b8	b6	b4	ANC binary group
b9	b7	b5	ANC binary group MSB
b10	b8	b6	12-bit - Even parity for data contained in UDW bit 9 through bit 0 10-bit - Even parity for data contained in UDW bit 7 through bit 0 8-bit - Even parity for data contained in UDW bit 5 through bit 0
b11 (MSB)	b9 (MSB)	b7	12-bit - Not bit 10. 10-bit - Not bit 8. 8-bit - Not bit 6.

6 Format of User Data Words in Ancillary Time Code Packet

6.1 Bit Assignments within the UDW

6.1.1 UDW Bits b9 and b8

Bits b9 shall equal not b8, and b8 shall be the even parity for bits b7 through b0.

6.1.2 UDW Bits b7 through b4

Bits b7 through b4 of UDW-1 through UDW-16 shall form an array of ancillary data groups into which the time code codewords formatted per SMPTE 12M-1 shall be mapped. Bit b4 of each UDW represents the LSB of each group. (see Table 6).

6.1.3 UDW Bit b3

Two groups of control bits shall be distributed across Bit b3 of UDW-1 through UDW-16 (see Figure 1, § 6.2, Table 2, and Table 3).

6.1.4 UDW Bits b2 through b0

Bits b2 through b0 shall be set to zero.

6.2 Distributed Binary Bits (DBB)

Bit b3 of UDW-1 through UDW-16 shall form two groups of distributed binary bits known as DBB1 and DBB2. Information coded in the DBB1 and DBB2 distributed binary bit groups are defined in Table 2 and Table 3, and is illustrated in Figure 1.

6.2.1 DBB1 – Payload Type

The first group of distributed binary bits (DBB1) shall be formed by bit 3 of UDW-1 through UDW-8, where UDW-1 (b3) represents the LSB and UDW-8 (b3) represents the MSB. The DBB1 bits shall define what type of data is being carried in the time code bits (b7 to b4) of the UDW as defined in Table 2.

6.2.1.1 Ancillary Time Code Linear Code Payload Type

The acronym “ATC_LTC” refers to ATC packets that carry linear time code (LTC) codewords as defined in SMPTE 12M-1 and have the distributed binary bit group 1 (DBB1) value of 00h. See Table 2.

6.2.1.2 Ancillary Time Code Vertical Interval Code #1 Payload Type

The acronym “ATC_VITC1” refers to ATC packets that carry vertical interval time code (VITC) codewords as defined in SMPTE 12M-1 and have the distributed binary bit group 1 (DBB1) value of 01h. See Table 2. The codeword contents shall comply with the requirements of SMPTE 12M-1 § 10.2 (“Codeword data content”), should carry a matching time address to any ATC_LTC packet carried in the same frame of video, and shall further comply with the requirements of § 9 in this document.

6.2.1.3 Ancillary Time Code Vertical Interval Code #2 Payload Type

The acronym “ATC_VITC2” refers to ATC packets that carry vertical interval time code (VITC) codewords as defined in SMPTE 12M-1 and have the distributed binary bit group 1 (DBB1) value of 02h. See Table 2. The codeword contents shall comply with the requirements of SMPTE 12M-1 § 10.2 (“Codeword data content”) and should carry a matching time address to any ATC_LTC packet carried in the same frame of video. See § 9 for additional information.

Table 2 – DBB1 (payload type) Distributed binary bit group coding

Bit 3 of UDW	Distributed binary bit (DBB1) MSB LSB	Definition
UDW-8 through UDW-1	0 0 0 0 0 0 0 0	Linear time code (ATC_LTC)
	0 0 0 0 0 0 0 1	Vertical interval time code #1 (ATC_VITC1)
	0 0 0 0 0 0 1 0	Vertical interval time code #2 (ATC_VITC2)
	0 0 0 0 0 0 1 1 through 0 0 0 0 0 1 0 1	User defined
	0 0 0 0 0 1 1 0	Film data block (transferred from reader [1])
	0 0 0 0 0 1 1 1	Production data block (transferred from reader[1])
	0 0 0 0 1 0 0 0 through 0 1 1 1 1 1 0 0	Locally generated time address and user data (user defined)
	0 1 1 1 1 1 0 1	Video tape data block (locally generated)
	0 1 1 1 1 1 1 0	Film data block (locally generated)
	0 1 1 1 1 1 1 1	Production data block (locally generated)
	1 0 0 0 0 0 0 0 through 1 1 1 1 1 1 1 1	Reserved

6.2.2 DBB2

The second group of distributed binary bits (DBB2) is formed by bit 3 of UDW-9 through UDW-16, where UDW-9 (b3) represents the LSB and UDW-16 (b3) represents the MSB. The assignments are defined in Table 3.

6.2.2.1 DBB2, Bits b4 through b0 – VITC line select

Bits b4 through b0 of the distributed binary bit group DBB2 convey the line number either from where the VITC codeword was recovered upon analog to digital conversion or where the time code should be converted to a VITC codeword modulated according to SMPTE 12M-1 and inserted into a standard definition analog or digital (using DVITC[2]) video signal interface. The line select number depends on the television system and shall be constrained to a range as shown in Table 4. These bits may be set to logical zero for digital interfaces, indicating “don’t care”.

Note: When ATC VITC codewords originate in high definition systems, the manufacturer may choose to ignore the possibility of downconversion.

6.2.2.2 DBB2, Bit b5

Bit b5 of DBB2 when set to 1 shall signify that the time codeword carried in the ATC_VITC1 or ATC_VITC2 packets, when converted to an analog video output signal, shall be inserted on the line number specified by DBB2 bits b4 through b0 and shall be repeated again on the selected line number + 2 (see Table 4, bit b5 = 1). This bit may be set to logical zero for high definition digital interfaces, indicating “don’t care”.

---

[1] See Table 11 of SMPTE RP 201.

[2] See SMPTE 266M.

6.2.2.3 DBB2, Bits b6 and b7

Bits b7 and b6 of the DBB2 word represent different time code condition bits (see Table 3). Bit b6 when set to logical one shall indicate that data errors were detected at the input to the ancillary time code formatter and the time address value has been interpolated. Bit b7 when see to logical zero shall indicate that the binary group data has been processed to compensate for processing delays as described in SMPTE 12M-1 § 11.2 (“Binary group data” within the “Relationship between LTC and VITC” section) . The coding of these two bits is shown in Table 5.

Table 3 – DBB2 (payload type) Distributed binary bit group coding

Bit 3 of UDW	Distributed binary bit (DBB2)	Definition
UDW-9	b0	VITC line select number LSB
UDW-10	b1	VITC line select number
UDW-11	b2	VITC line select number
UDW-12	b3	VITC line select number
UDW-13	b4	VITC line select number MSB
UDW-14	b5	VITC line duplication flag
UDW-15	b6	Time code validity
UDW-16	b7	(User bits) process bit

DBB2 bits 0 through 5 may be set to logical zero for high definition digital applications.

Table 4 – VITC Line select number (SDTV interfaces only)

(VITC line select number)					525/60		625/50	
					bit b5 = 0	bit b5 = 1	bit b5 = 0	bit b5 = 1
DBB2 bits b4 through b0					VITC on line N	Repeated VITC on line (N+2)	VITC on line N	Repeated VITC on line (N+2)
b4	b3	b2	b1	b0	field 1/field 2 [3]	field 1/field 2	field 1/field 2	field 1/field 2
0	0	1	1	0	—	—	6/319	8/321
0	0	1	1	1	—	—	7/320	9/322
0	1	0	0	0	—	—	8/321	10/323
0	1	0	0	1	—	—	9/322	11/324
0	1	0	1	0	10/273	12/275	10/323	12/325
0	1	0	1	1	11/274	13/276	11/324	13/326
0	1	1	0	0	12/275	14/277	12/325	14/327
0	1	1	0	1	13/276	15/278	13/326	15/328
0	1	1	1	0	14/277	16/279	14/327	16/329
0	1	1	1	1	15/278	17/280	15/328	17/330
1	0	0	0	0	16/279	18/281	16/329	18/331
1	0	0	0	1	17/280	19/282	17/330	19/332
1	0	0	1	0	18/281	20/283	18/331	20/333
1	0	0	1	1	19/282	—	19/332	21/334
1	0	1	0	0	20/283	—	20/333	22/335
1	0	1	0	1	—	—	21/334	—
1	0	1	1	0	—	—	22/335	—

Table 5 – Coding of validity and process bits

Time code validity bit (b6) and process bit (b7)	Definition
b6 = 0	No time code error received or locally generated time code address
b6 = 1	Transmitted time code interpolated from previous time code (received a time code error)
b7 = 0	Binary groups in time code data stream are processed to compensate for latency
b7 = 1	Binary groups in time code data stream are only retransmitted (no delay compensation)

[3] Field 1 and Field 2 terminology applies, strictly speaking, to analog systems only. Digital systems use Field 0 and Field 1.

6.3 Mapping of the Time Code Data into Ancillary Data Packets

Mapping of the time code data into the UDW 1 through UDW 16 of the ancillary time code data packet shall be as shown in Table 6.

Only the 64 information bits of the time code data shall be transferred to the ATC. The LTC sync word (bits 64-79) and the VITC(1/0) sync bit pairs and the CRC word shall be omitted from the ancillary time code packets.

Note: The mapping of film transfer information (i.e., video tape, film, and production data blocks) into VITC space is defined in SMPTE RP 201.

Table 6 – Mapping of Time code Data into UDW[4]

ATC		SMPTE 12M-1		
UDW	**Bit**	**LTC bit**	**VITC bit**	**Time code bit definitions**
1	4	0	2	Units of frames 1
	5	1	3	Units of frames 2
	6	2	4	Units of frames 4
	7	3	5	Units of frames 8
2	4	4	6	LSB binary group 1
	5	5	7	xxx binary group 1
	6	6	8	xxx binary group 1
	7	7	9	MSB binary group 1
3	4	8	12	Tens of frames 10
	5	9	13	Tens of frames 20
	6	10	14	Flag
	7	11	15	Flag
4	4	12	16	LSB binary group 2
	5	13	17	xxx binary group 2
	6	14	18	xxx binary group 2
	7	15	19	MSB binary group 2
5	4	16	22	Units of seconds 1
	5	17	23	Units of seconds 2
	6	18	24	Units of seconds 4
	7	19	25	Units of seconds 8
6	4	20	26	LSB binary group 3
	5	21	27	xxx binary group 3
	6	22	28	xxx binary group 3
	7	23	29	MSB binary group 3
7	4	24	32	Tens of seconds 10
	5	25	33	Tens of seconds 20
	6	26	34	Tens of seconds 40
	7	27	35	Flag

[4] See Table 11 in SMPTE 12M-1.

ATC		SMPTE 12M-1		
UDW	**Bit**	**LTC bit**	**VITC bit**	**Time code bit definitions**
8	4	28	36	LSB binary group 4
	5	29	37	xxx binary group 4
	6	30	38	xxx binary group 4
	7	31	39	MSB binary group 4
9	4	32	42	Units of minutes 1
	5	33	43	Units of minutes 2
	6	34	44	Units of minutes 4
	7	35	45	Units of minutes 8
10	4	36	46	LSB binary group 5
	5	37	47	xxx binary group 5
	6	38	48	xxx binary group 5
	7	39	49	MSB binary group 5
11	4	40	52	Tens of minutes 10
	5	41	53	Tens of minutes 20
	6	42	54	Tens of minutes 40
	7	43	55	Flag
12	4	44	56	LSB binary group 6
	5	45	57	xxx binary group 6
	6	46	58	xxx binary group 6
	7	47	59	MSB binary group 6
13	4	48	62	Units of hours 1
	5	49	63	Units of hours 2
	6	50	64	Units of hours 4
	7	51	65	Units of hours 8
14	4	52	66	LSB binary group 7
	5	53	67	xxx binary group 7
	6	54	68	xxx binary group 7
	7	55	69	MSB binary group 7
15	4	56	72	Tens of hours 10
	5	57	73	Tens of hours 20
	6	58	74	Flag
	7	59	75	Flag
16	4	60	76	LSB binary group 8
	5	61	77	xxx binary group 8
	6	62	78	xxx binary group 8
	7	63	79	MSB binary group 8

Note: Appropriate flag information for each television system as per SMPTE 12M-1 is inserted into the corresponding positions marked as *flag.*

7 Transmission of Ancillary Time Code Packets

7.1 Multiple Transmission of ATC Packets

Multiple transmissions of ancillary time code packets per video frame are permissible under the provisions of this Standard.

Note: This provision permits transmission of different ATC packets within a single video frame; as, for example, an ATC packet containing LTC codewords (i.e., an ATC_LTC payload type) and a second ATC packet containing VITC codewords (ATC_VITC1 or ATC_VITC2 payload type). The time code codewords in these two packets should correspond to the relevant video frame (see § 9).

7.2 ATC Packet Transmission Rate

In interlaced and segmented frame video formats, transmission of ancillary time code packets shall be at least once per frame for a packet containing LTC codewords and once per field or segment for a packet containing VITC codewords. The preferred implementation uses a packet of the ATC_VITC1 payload type for field or segment one and a packet of the ATC_VITC2 payload type for field or segment two.

In progressive frame video formats, transmission of ancillary time code packets shall be at least once per frame for a packet containing LTC codewords and once per frame for a packet containing VITC codewords.

For progressive systems running at less than or equal to 30 frames-per-second, the ATC_VITC1 payload type with the field mark flag set to zero should be used to carry VITC codewords.

For progressive systems running at greater than 30 frames-per-second, a packet of the ATC_VITC1 payload type with the field mark flag set to zero and associated with the first frame of a pair should alternate with a packet of the ATC_VITC2 payload type with the field mark flag set to one and associated with the second frame of a pair as required by SMPTE 12M-1 § 12.1 (“Time address of a frame in 50 and 60 frames-per-second progressive systems”). See also § 9.2.

Note: Receiver implementers should be aware that a variety of legacy implementations exist, some using the ATC_VITC2 payload type in place of the ATC_VITC1 payload type or vice versa. Receivers are expected to handle any combination of VITC codewords that may be presented to them.

Note: Users of this standard are advised that implementations of time code for progressive television systems with a frame-per-second count greater than 30 fps have been implemented without the labeling of individual frames within a frame pair using the field mark flag (i.e., the value of the field flag is always zero) or without using ATC_VITC1 to signal the first frame and ATC_VITC2 the second frame of a pair. This may lead to interoperability problems.

8 Ancillary Time Code Packet Location

8.1 Permissible Insertion Locations

Insertion of ancillary time code (ATC) packets into any available location in the digital data stream is permitted under the provisions of this standard.

8.2 Preferred Locations for placement of ATC

Preferred locations for insertion of ancillary time code (ATC) packets are video format-dependent and shall be based on the applicable standard for the format. ATC may be inserted within the available ancillary space located within vertical blanking after the vertical interval switching point defined in SMPTE RP 168 and before the beginning of active video.

Note: The preferred location for film transfer information packets (i.e., video tape, film, and production data blocks) is defined in SMPTE RP 201.

8.2.1 High Definition Television (HDTV) Systems

When the ANC packets are carried in a high definition signal they shall be carried in the Y stream.

Due to limitations of legacy equipment, the preferred location for insertion of ancillary time code (ATC) packets into a high definition digital video signal stream should be as shown in Table 7.

Table 7 – Preferred locations for Insertion in HDTV signals

Payload type (as per Table 2)	Video Format (interface line numbers)		
	1125 line Interlaced / segmented frame	1125 line progressive	750 line progressive
ATC_LTC	HANC, Line 10	HANC, Line 10	HANC, Line 10
ATC_VITC1	HANC, Line 9	HANC, Line 9	HANC, Line 9
ATC_VITC2	HANC, Line 571	HANC, Line 9	HANC, Line 9
Other payload types	except lines 9, 10, and 571	except lines 9, and 10	except lines 9 and 10

Notes:

1) The locations shown in Table 7 are compatible with the recommendations of ITU-R BT.1366 and (for 1125 line interlaced) ARIB Standard B4. Users of this standard are advised that devices that are designed to support these locations may not decode ATC packets that are located elsewhere.

2) When dual link SMPTE 372M interface is used for an 1125 line progressive system, the locations of embedded time code packets in each link are the same as for 1125 line interlaced formats.

8.2.2 Standard Definition Television (SDTV) Systems

The Preferred location for insertion of ATC packets in an SDTV digital video signal is in VANC as early as possible after the second line after the line specified for switching, as defined in SMPTE RP 168.

Note: Designers should be aware that although this standard prefers VANC as the location for the transport of codewords in an SD-SDI interface, there are legacy devices that will place it in HANC.

9 Correspondence Between LTC/VITC and ATC

Time address information (LTC or VITC) contained in an ATC packet shall correspond to the respective video frame or field in which the ATC packet resides. Look-ahead compensation shall be applied to the time code (LTC or VITC) time address count when converting between ATC and either LTC or VITC. Additional information on converting both time address and binary group data between LTC and VITC is contained in SMPTE 12M-1 § 11 ("Relationship between LTC and VITC").

9.1 Field Flag for Interlaced Television Systems

Transmission of the VITC word for field 1 or field 2 in the ATC, shall use the ATC_VITC1 and ATC_VITC2 payload types, as specified in § 7.2, and shall signal field identification using the field mark flag defined by SMPTE 12M-1. However, when ATC is converted to VITC in an analog television signal according to § 9 (“Linear Time Code application”) of SMPTE 12M-1 (and Table 4 of this document), the field mark flag of the VITC data shall be set according to the field into which the output is inserted.

9.2 Progressive Television Systems with Frame Rates Greater than 30 Frames Per Second

In progressive television systems with a frame-per-second count greater than 30 frames per second, a single time address label shall identify a pair of frames as specified in § 12 (“Progressive Systems with frame rates greater than 30 frames per second”) of SMPTE 12M-1. LTC data contained in an ATC packet shall be aligned with the video as specified in § 12.1 of SMPTE 12M-1.

Implementations of ATC time code first implemented after the publication of this document shall conform to the following requirements: VITC data in ATC_VITC1 and ATC_VITC2 payload types, (as specified in § 7.2,) shall use the field mark flag to identify each of the frames of a frame pair as follows: A logical zero shall represent the first frame and a logical one shall represent the second frame of the pair of progressive frames.

Note: Implementations of ATC time code implemented before this date and which always set the value of the field flag to zero are considered compliant implementations of this standard.

9.3 Implementation Guidelines (Informative)

Users of this standard are advised that initial implementations of progressive television systems with a frame-per-second count greater than 30 frames per second have been implemented without the marking of individual frames within a frame pair using the field mark flag (i.e. the value of the field flag is always zero). Other implementations do utilize the field flag to signal frame pair alignment with LTC, such that the first frame of a pair is assigned field flag value of zero and the second frame is assigned the value of one.

As is noted earlier in § 6.2.1.3, there may be no implied association between the ATC_VITC2 payload data and the progressive frame pair. Some manufacturers have implemented an association (either ATC_VITC1 with the first frame and ATC_VITC2 with the second frame, or alternatively, ATC_VITC1 with field mark flag identifying each of the frames) and others have not.

Some implementations of interlaced and segmented frame television systems have been implemented using the ATC_VITC1 packet in field/segment 1 and the ATC_VITC2 packet in field/segment 2, with the field flag set to logical zero in both packets.

Users are advised to verify which of these methods is implemented in their equipment, so that interoperability problems can be avoided. All new implementations, to be compliant with the requirements of SMPTE 12M-1 § 12.1, will implement the use of the field mark flag in ATC_VITC1 payload data.

Annex A (Informative)
Bibliography

ARIB STD B4, Version 2,0, Time Code Conveyed by Ancillary Data Packets for 1125/60 Television Systems (available in the Japanese language only)

ITU-R BT.1700-1 (2005), Annex 2, Characteristics of Composite Video Signals for Conventional Analogue Television Systems

ITU-R BT.1366 (1998), Transmission of Time Code and Control Code in the Ancillary Data Space of a Digital Television Stream According to ITU-R BT.656, ITU-R BT.799, and ITU-R BT.1120

SMPTE 170M-2004, Television — Composite Analog Video Signal — NTSC for Studio Applications

SMPTE 260M-1999, Television — 1125/60 High-Definition Production System — Digital Representation and Bit-Parallel Interface

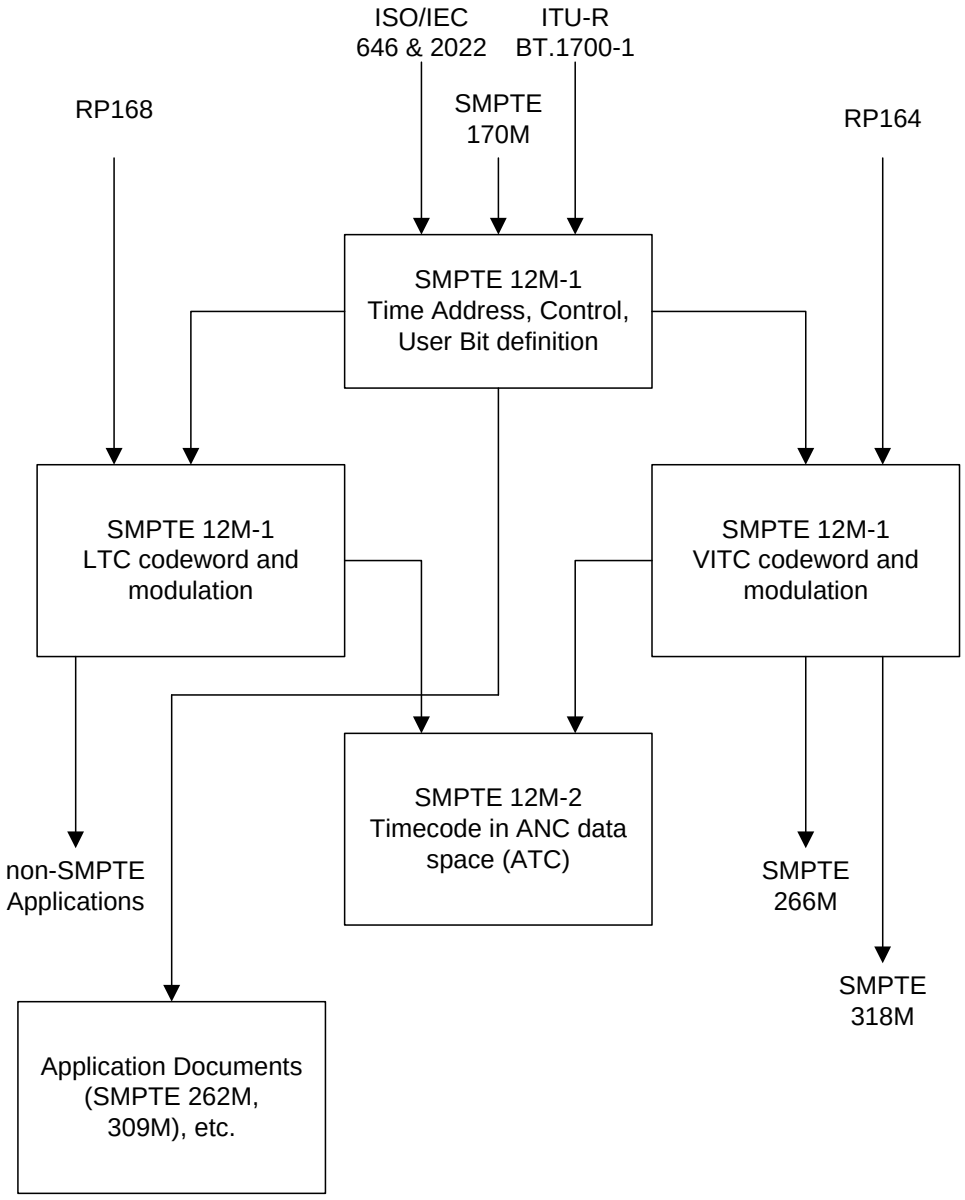
SMPTE 266M-2002, Television — 4:2:2 Digital Component Systems — Digital Vertical Interval Time Code

SMPTE 274M-2008, Television — 1920 x 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates

SMPTE 292-2008, 1.5 Gb/s1 Signal / Data Serial Interface

SMPTE RP 201-2004, Encoding Film Transfer Information Using Vertical Interval Time Code

Annex B (Informative)
Time Code System "Roadmap"



Note: SMPTE 12M-2 was formerly SMPTE RP 188.